

WHAT IS CLAIMED IS:

1. A DNA construct comprising nucleic acid encoding an influenza virus gene, wherein said DNA construct is capable of inducing the expression of an antigenic influenza virus gene product which induces an influenza virus specific immune response upon introduction of said DNA construct into animal tissues in vivo and resultant uptake of the DNA construct by cells which express the encoded influenza gene.
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2. The DNA construct of Claim 1 wherein the influenza virus gene encodes nucleoprotein, hemagglutinin, polymerase, matrix, or non-structural human influenza virus gene products.
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3. A polynucleotide vaccine comprising a DNA construct which induces neutralizing antibody against human influenza virus, influenza virus specific cytotoxic lymphocytes, or protective immune responses upon introduction of said DNA pharmaceutical into animal tissues in vivo, wherein the animal is a vertebrate, and the polynucleotide vaccine encodes an influenza virus gene which is expressed upon introduction into said vertebrates' tissues in vivo.
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4. The polynucleotide vaccine of Claim 3 which contains a DNA construct selected from one or more of:
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a) pnRSV-PR-NP,
b) V1-PR-NP,
c) V1J-PR-NP, the 5' end of which is SEQ. ID:12:;
d) V1J-PR-PB1, the 5' end of which is SEQ. ID:13:;
e) V1J-PR-NS, the 5' end of which is SEQ. ID:14:;
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f) V1J-PR-HA, the 5' end of which is SEQ. ID:15:;
g) V1J-PR-PB2, the 5' end of which is SEQ. ID:16:;
h) V1J-PR-M1, the 5' end of which is SEQ. ID:17:;
i) V1Jneo-BJ-NP, the 5' end of which is SEQ. ID:20: and the 3' end of which is SEQ. ID:21:;

- j) V1Jneo-TX-NP, the 5' end of which is SEQ. ID:24 and the 3' end of which is SEQ. ID:25: and
- k) V1Jneo-PA-HA, the 5' end of which is SEQ. ID:26: and the 3' end of which is SEQ. ID:27:
- 5 l) V1Jns-GA-HA (A/Georgia/03/93), construct size 6.56 Kb, the 5' end of which is SEQ.ID:46: and the 3' end of which is SEQ. ID:47:;
- m) V1Jns-TX-HA (A/Texas/36/91), construct size 6.56 Kb, the 5' end of which is SEQ.ID:48: and the 3' end of which is SEQ. ID:49:;
- 10 n) V1Jns-PA-HA (B/Panama/45/90), construct size 6.61 Kb, the 5' end of which is SEQ.ID:50: and the 3' end of which is SEQ. ID:51:;
- o) V1Jns-BJ-NP (A/Beijing/353/89), construct size 6.42 Kb, the 5' end of which is SEQ.ID:52: and the 3' end of which is SEQ. ID:53:;
- 15 p) V1Jns-BJ-M1 (A/Beijing/353/89), construct size 5.62 Kb, the 5' end of which is SEQ.ID:54: and the 3' end of which is SEQ. ID:55:;
- 20 q) V1Jns-PA-NP (B/Panama/45/90), construct size 6.54 Kb, the 5' end of which is SEQ.ID:56: and the 3' end of which is SEQ. ID:57:; and
- r) V1Jns-PA-M1 (B/Panama/45/90), construct size 5.61 Kb, the 5' end of which is SEQ.ID:58: and the 3' end of which is SEQ. ID:59:.

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- 5. The expression vector V1J, SEQ. ID:10:.
- 6. The expression vector V1J-neo, SEQ. ID:18:.
- 30 7. A method for protecting against infection by human influenza virus which comprises immunization with a prophylactically effective amount of the DNA of Claim 1.

8. A method for protecting against infection by human influenza virus which comprises immunization with a prophylactically effective amount of the DNA of Claim 3.

5 9. A method for protecting against infection by human influenza virus which comprises immunization with a prophylactically effective amount of the DNA of Claim 4.

10 10. The method of Claim 7 which comprises direct administration of the DNA into tissue in vivo.

15 11. The method of Claim 10 wherein the DNA is administered either as naked DNA in a physiologically acceptable solution without a carrier or as a mixture of DNA and a liposome, or as a mixture with an adjuvant or a trasfection facilitating agent.

12. A method for using an influenza virus gene to induce immune responses in vivo which comprises:
a) isolating the gene,
20 b) linking the gene to regulatory sequences such that the gene is operatively linked to control sequences which, when introduced into a living tissue direct the transcription initiation and subsequent translation of the gene, and
c) introducing the gene into a living tissue.

25 13. The method of Claim 12 which further comprises boosting induced immune responses by introducing influenza virus gene on multiple occasions.

30 14. The method of Claim 12 wherein the influenza virus gene encodes a human influenza virus nucleoprotein, hemagglutinin, matrix, nonstructural, or polymerase gene product.

15. The method of Claim 14 wherein the human influenza virus gene encodes the nucleoprotein, basic polymerase1, nonstructural protein1, hemagglutinin, matrix1, or basic polymerase2 of one or more of the human influenza virus isolates A/PR/8/34,
5 A/Beijing/353/89, A/Texas/36/91, A/Georgia/03/93, and B/Panama/45/90.

16. A method for inducing immune responses against infection or disease caused by strains of influenza virus which comprises
10 introducing into a vertebrate a nucleic acid which encodes a conserved influenza virus epitope specific to a first influenza virus strain such that the induced immune response protects not only against infection or disease by the first influenza virus strain but also protects against infection or disease by strains that are different to said first strain.

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17. The method of Claim 7 wherein the organism being treated by the method is a human.

18. The DNA:
20 a) pnRSV-PR-NP,
b) V1-PR-NP,
c) V1J-PR-NP, the 5' end of which is SEQ. ID:12:;
d) V1J-PR-PB1, the 5' end of which is SEQ. ID:13:;
e) V1J-PR-NS, the 5' end of which is SEQ. ID:14:;
25 f) V1J-PR-HA, the 5' end of which is SEQ. ID:15:;
g) V1J-PR-PB2, the 5' end of which is SEQ. ID:16:;
h) V1J-PR-M1, the 5' end of which is SEQ. ID:17:;
i) V1Jneo-BJ-NP, the 5' end of which is SEQ. ID:20: and the 3' end of which is SEQ. ID:21:;
30 j) V1Jneo-TX-NP, the 5' end of which is SEQ. ID:24 and the 3' end of which is SEQ. ID:25: and
k) V1Jneo-PA-HA, the 5' end of which is SEQ. ID:26: and the 3' end of which is SEQ. ID:27:
l) V1Jns-GA-HA (A/Georgia/03/93), construct size 6.56 Kb,

the 5' end of which is SEQ.ID:46: and
the 3' end of which is SEQ. ID:47:,
m) V1Jns-TX-HA (A/Texas/36/91), construct size 6.56 Kb,
the 5' end of which is SEQ.ID:48: and
the 3' end of which is SEQ. ID:49:,
5 n) V1Jns-PA-HA (B/Panama/45/90), construct size 6.61 Kb,
the 5' end of which is SEQ.ID:50: and
the 3' end of which is SEQ. ID:51:,
o) V1Jns-BJ-NP (A/Beijing/353/89), construct size 6.42 Kb,
the 5' end of which is SEQ.ID:52: and
the 3' end of which is SEQ. ID:53:,
10 p) V1Jns-BJ-M1 (A/Beijing/353/89), construct size 5.62 Kb,
the 5' end of which is SEQ.ID:54: and
the 3' end of which is SEQ. ID:55:,
15 q) V1Jns-PA-NP (B/Panama/45/90), construct size 6.54 Kb,
the 5' end of which is SEQ.ID:56: and
the 3' end of which is SEQ. ID:57:, and
r) V1Jns-PA-M1 (B/Panama/45/90), construct size 5.61 Kb,
the 5' end of which is SEQ.ID:58: and
the 3' end of which is SEQ. ID:59:,
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19. A composition of nucleic acid constructs encoding influenza virus genes from both A-type and B-type human influenza viruses.

25 20. The composition of Claim 19 comprising nucleic acid constructs encoding the hemagglutinin gene of at least three strains of influenza virus, the nucleoprotein gene of at least two strains of influenza virus, and the matrix protein gene of at least two strains of influenza virus.

30 21. The composition of Claim 19 wherein said influenza virus genes are derived from influenza viruses of the H1N1, H2N2, and H3N2 and B strains of influenza virus.

22. The composition of Claim 19 comprising :

5 a) V1Jns-GA-HA (A/Georgia/03/93), construct size 6.56 Kb, the 5' end of which is SEQ.ID:46: and the 3' end of which is SEQ. ID:47:;

10 b) V1Jns-TX-HA (A/Texas/36/91), construct size 6.56 Kb, the 5' end of which is SEQ.ID:48: and the 3' end of which is SEQ. ID:49:;

15 c) V1Jns-PA-HA (B/Panama/45/90), construct size 6.61 Kb, the 5' end of which is SEQ.ID:50: and the 3' end of which is SEQ. ID:51:;

d) V1Jns-BJ-NP (A/Beijing/353/89), construct size 6.42 Kb, the 5' end of which is SEQ.ID:52: and the 3' end of which is SEQ. ID:53:;

15 e) V1Jns-BJ-M1 (A/Beijing/353/89), construct size 5.62 Kb, the 5' end of which is SEQ.ID:54: and the 3' end of which is SEQ. ID:55:;

f) V1Jns-PA-NP (B/Panama/45/90), construct size 6.54 Kb, the 5' end of which is SEQ.ID:56: and the 3' end of which is SEQ. ID:57:; and

20 g) V1Jns-PA-M1 (B/Panama/45/90), construct size 5.61 Kb, the 5' end of which is SEQ.ID:58: and the 3' end of which is SEQ. ID:59:.

25 23. The expression vector V1Jns.

24. The expression vector V1JR, SEQ. ID:45:.

30 25. The use of an isolated human influenza virus gene operatively linked to one or more control sequences for incorporation in a vaccine for use in immunization against infection by human influenza virus.